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Study on the Surface Roughness Expression

(Particularly of the ground surface)

Akihide KATO (加 藤 明 英)

Maximum height (Hmax) and root mean square height (Hrms) are commonly used to express the surface roughness. Statistically, Hmax is a quantity to indicate the range, and Hrms indicates the standard deviation in the surface roughness. We have taken the ground surface as the one of the machined surface. The relationships of the grinding conditions and the both of Hmax and Hrms have been researched and Hmax/Hrms ($=K$) have been derived. With this, the significance of K as one of the characteristic factors to express these surface roughness curves has been studied. The micro geometrical shapes of the surface roughness curves in the grinding direction and the direction perpendicular to the grinding direction have been compared with K.

The findings are as follows:

(1) The value of K of the ground surface in the range of 0.9~10.1 μ (Hmax) is

$$K=5.47\ (3.20\sim9.54)\ (\sigma=1.10)$$

(2) K increases as the table speed, the grain size, the dressing speed and the dressing depth of cut increase.

(3) The ratios of the roughness in the perpendicular direction and the grinding direction are 1.3~4.0 (Hmax) and 1.7~4.5 (Hrms). These ratios increase as the cumulative metal removed increase.

(4) The shape of the roughness curves of the grinding direction is more irregular than that of the perpendicular direction.

The Experimental Research on Plastic Forming by the Vibration Method

Kotaro KANEKO (金 子 洪 太 郎)

Recently, there has been a tendency that the vibration, especially, ultrasonic is applied to plastic forming. And many useful effects have been discovered with respect to wire-drawing, rolling, press, punching and so on.

Up to date, however, the fundamental investigations which make it enable to explain the mechanism of the foregoing effects, are very few.

Then, in this experiment, high-amplitude vibration with low frequency (50 c/sec) was adopted. Through the experiment that the vibration was superposed on the common tensile test and Brinell hardness test, the plastic behaviors and the change of mechanical properties of the materials were investigated. The testing materials were S15C, Al and nylon.

According to the result of this experiment, the influences of the vibration are insignificant where stress amplitude σ_a is small. But by the much more intense vibration, the tendency of softening increases rapidly. For instance, elongation increases about 10%, (S15C, σ_a=20kg/mm^2) and 13% (Al, σ_a=7.5kg/mm^2) in comparison with that obtained by the common tensile test. This is mainly due to the action of heat produced by plastic hysterisis of Bauschinger's effect.

In hardness test, when the vibration is superposed, nylon shows very different behavior from that of metals.

The conclusion obtained from this experimental research is as follows:

The influence on the materials by the high-amplitude vibration is attributed to the effect of heat produced in the materials.

The Influence of Flexible Wall for the Transformation Phenomena from Laminar to Turburent Flow

Tohru KIKUCHI (菊 池 徹)

When the non-rigid material, namely, flexible material, is placed in the stream, between that material and flow field, it causes a physical interaction, such as, transfer of momentum and energy. Therefore, if the disturbance occurred in the flow, it would be possible that the flexible material would absorb the disturbance energy, so that the stream is stabilized and the drag due to friction is reduced. According to this idea, Krammer reported that when the material with flexible wall containing damping oil was towed by a ship, it brought remarkable drag reduction is mainly caused; (1) Laminar flow is stabilized. (2) Drag reduction in turburent flow, and (3) The effect of damping oil.

From the engineering view point, lots of studies have been made, i.e. (1) was investigated by the linealized stability theory, and (2) was also investigated experimentally, however, none of the result coincide with the Krammer's experimental result.

It this thesis, the author experimentally investigated the influence of the flexible wall using rectangular conduits and has obtained the following results:

(1) Flexible wall causes the increase in Critical Reynolds Number by 600 compared with rigid wall.